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Nutritional and phytochemical screening of *Senna obtusifolia* indigenous to Mubi, Nigeria

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ABSTRACT

Nutritional and phytochemical screening of leaves and seeds of Senna obtusifolia were investigated. Phytoconstituents present in the seeds and leaves observed were tannins, flavonoids, steroids and phylobatannins. Terpenoids and alkaloids were found only in the plant leaves. Saponins were only found in the seeds. Flavonoids were observed to be more abundant in seed extract (99%) than in leaves extract (66%). Alkaloids absent in seeds and only 33% in leaves. Both leaves and seeds showed sufficient mineral elements: - Ca, N, Cu, and Na with good nutritive value and rich in carbohydrates and proteins but low in fat. The seeds and leaves of this plant showed high nutritive value with maximum percentages of important minerals. This can be used in healthcare during anemic conditions. The high percentage of carbohydrate in seeds than leaves can be exploited in feed formulation for livestock.

Key words: *Senna obtusifolia*, phytoconstituents, protein, carbohydrate, feed formulation.

INTRODUCTION

The plant *Senna obtusifolia* belongs to the kingdom plantae, family fabaceae. A common annual plant grows wild in Northern Nigeria. The plant is considered a serious weed to Agriculturalists in many places. A competitive woody shrub grows vigorously across the tropics. It grows on well-drained fertile soil. Similarly, it is suited for cleared coastal forest countries. Irwin and Barneby [1] indicated that *Senna obtusifolia* (L.) is used as mulch interplant to smother weeds in the crop interrows and to generate mulch *in situ* for the production of *C. frutescens*; Sombo (Nigeria), Tabasco (Benin). *Senna obtusifolia* been regarded as indigenous leafy vegetable of the Sahel with potential of providing vegetable to the rural population in the month of August and September [2]. *Senna obtusifolia* found throughout tropical Africa with the exception of Madagascar. It was an early introduction into Africa from America, where it showed far more variation. In Africa, the fruits are broad as in specimens from the Caribbean and southern united states, which suggests a Caribbean origin of the African plants. In Asia, plants with broad fruits

are widespread, but in the Philippines, only plants with needle-like fruits occur. The young tender leaves of *Senna obtusifolia* occasionally used as vegetable throughout Africa and elsewhere and the plant is cultivated in home for this purpose in several countries including Senegal, Ghana, Cameroon, and Ethiopia. Older leaves if eaten frequently or in large quantities will cause diarrhea [1]. In Nigeria, the seeds, leaves, and roots of *Senna obtusifolia* is of no doubt posses' laxatives effects. Its leaves used as decoction febrifuge and for the treatment of scorpion stings, gingivitis, dysentery and diarrhea [3, 4]. As the seeds are reputedly poisonous, therefore cooking or roasting it is necessary before eating. The cooked vegetable tastes bitter but has an attractive consistency. *Senna obtusifollia* will probably remain a minor vegetable. Seed gums are used worldwide for a variety of industrial application increase demand and inconsistency of supply and price driven industrial users to search for new sources of supply and *Senna obtusifolia* is a good alternative for locust bean (*Ceratonia siliqua L.*) and guar (*Cyomopsis tetragonolobia* (*L)* taub). The medicinal properties of this plant also justify more research. However, the weedy nature and the toxic properties require caution [1].

Phytochemical screening of *Senna obtusifolia* revealed that the extracts contained some phytoconstituents; saponins, tannins, alkaloids and flavonoids are present in the acetone extracts; tannins, alkaloids and flavonoids are found in the methanol extracts; alkaloid and flavonoids are found in water extract. All the extracts demonstrated antimicrobial activity against the test bacteria with acetone extract demonstrating the highest activity while the water extract demonstrated the least activity [5].

Considering the wide medicinal application of this plant, it become imperative to investigate the plant of its phytochemicals, and antimicrobial activity against some pathogenic bacteria and generate data for the development of this plant as medicinal source in the developing countries.

MATERIALS AND METHODS

Sample Collection

Senna obtusifolia leaves collected within Mubi town and authenticated by Mr. Ibrahim T. Yusuf of Divisional Forest Office, Mubi North Local Government Area of Adamawa State. The leaves separated from stems, washed in clean water, and dried at room temperature [6], and the seeds pounded in laboratory mortar and sieved using a 1mm mesh sieve.

Extraction Procedure

Dried plants were used and bioactive compounds extracted by first weighing samples of 1g of finely ground plant material and mixing with 10ml of acetone, methanol, and boiled water in polyester centrifuge tubes. Tubes containing extracts were vigorously shook for 3 to 5 min on shaking machine at high speed. After centrifugation at 3500 rpm for 10min the supernatants decanted into pre-weighed, labeled containers. The process repeated three times, which exhaustively extracts the plant material and the extracts re-combined. The solvent removed under a stream of air in a fume cupboard at room temperature [7, 8].

Phytochemical Screening

Chemical tests was carried out on the aqueous extract and on the powdered specimen using standard procedures to identify the constituents as described by Sofowora [9], Trease and Evans [10] and Harborne [11].

Test for nutritive value and elemental composition

Determination of Protein using micro kjedahl method

1g each of the seeds and leaves taken in 250 ml Pyrex digestion tubes and 30 ml of conc. H_2SO_4 each carefully added. Then 10 g potassium sulphate and 14 g copper sulphate, were added and the mixture placed on sand bath at a low flame to boil the solution. This was heated further till the solution became colorless and clear and was allowed to cool. Then diluted with distilled water and transferred into 800 ml kjeldahl flask. The digestion flask washed, four (4) pieces of granulated zinc and 100ml of 40% caustic soda added, and the flask connected with the splash heads of the distillation apparatus. Next 25 ml of 0.1N sulphuric acids taken in the receiving flask and distilled: then tested for completion of reaction. The flask was removed and titrated against 0.1N caustic soda solution using methyl red indicator for determination of Nitrogen, which in turn gave the protein content [12]

Determination of crude fat

Fat content was determined using standard method. Crude fat was determined by extracting 1g each of moisture free sample with diethyl ether in a soxhlet extractor, heating the flask on sand bath for one hour until a drop taken with care so that the dripping leaves no greasy stain on the filter paper. The residual diethyl ether was filtered using Whitman No 40 filter paper and the filtrate evaporated in a pre weighed clean beaker.

Determination of crude fiber

2 g each of moisture and fat free material treated with 200ml of 1.25% H_2SO_4. After filtration and washing, the residue treated with 1.25% NaOH. Then washed with hot distilled water and diluted with 1% HNO_3, filtered, and washed with hot distilled water again. The residue ignited and the ash weighed to give the weight of crude fiber [13].

Determination of moisture content

Moisture content was determined using standard method. Fresh leaves kept in a pre weighed watch glass and dried at 150^{o}C over night, in oven. The sample with watch glass cooled to room temperature in a desiccator before weighing. The weight loss in sample, regarded as moisture content of the sample.

Determination of ash content

The ash content was determined as described by Sadasivam and Manickam [14]: 5 g of each sample was weighed and taken in silica crucible and heated first over a low flame till all the material was completely charred, followed by heating in a muffle furnace for about 5 hours at 600^{o}C. Then the samples cooled in a desiccator and weighed again to ensure completion of ashing. Again, was heated in muffle furnace for 1hour, cooled and weighed. This was repeated consequently until the weight of the samples became constant (Ash became grayish white).
Weighed of [(Ash+ Crucible)-(weight of Crucible)] =Ash content

Determination of percentage carbohydrate

Percentage carbohydrate=100 - (percentage of ash + percentage of moisture + percentage of fat + percentage of protein).

Nutritive value was finally determined thus:

Nutritive value= (4 × percentage of protein) + (9 × percentage of fat) + (4 × percentage of carbohydrate).

Elemental analysis

5 g each of powdered shoot taken in pre-cleaned and constantly weighed silica crucible and heated in muffle furnace at 400^{o}C until there was no evolution of smoke. The crucible cooled in a desicator to room temperature. The ash totally free from carbon was moistened with concentrated H2SO4 and heated on a hot plate till fumes of sulphuric acid evolved. The silica crucible with sulphated ash again heated at 600^{o}C in muffle furnace until weight of sample was constant (4hrs). 1g sulphated ash taken in a beaker and dissolved in 100 ml of 5% conc. HCl to obtain the solution for determination of Na, and Ca. The A.A.S and titration methods respectively were used [15].

Determination of Cu and Mn: 1.25g each of the dried samples transferred to the destruction tube (kjeldal flask), 25 ml HNO_3 added, three boiling chips added and a funnel placed on top of the destruction tube. The tubes each heated to 100^{o}C, 125^{o}C, 150^{o}C and maintained at each interval for 1hr, 15 min and 15 min respectively allowed to cool to room temperature. The tubes again heated to 200^{o}C and concentrated to 5 ml. After cooling, 1M of 3% H_2O_2 was added and was destructed for 10minutes. It was cooled again after adding 3 ml 30% H_2O_2 and destructed for 10min; 25 ml water was added and heated until boiling. The whole sample was cooled and transferred to a 250 ml volumetric flask and was made up to the mark, it was shaken and allowed to settle. The absorbance of the clear supernatant measured using atomic absorption spectrometer and various concentrations wiere determined from the standard calibration curve [16].

RESULTS AND DISCUSSION

Table 1: Phytochemical screening of *Senna obtusifolia* leaves and seeds

Phytochemicals	Leaves extract	Seed extract
Tannins	+++	+++
Flavonoids	++	+++
Saponins	+++	+++
Terpenoids	+++	+++
Steroids	+++	+++
Phlabathannins	+++	+++
Alkaloids	+	-

The result of phytochemical screening of *Senna obtusifolia* leaves and seeds (Table 1) shows that all the phytochemical (tannins, flavonoids, saponins, terpenoids, steroids, phlabathannins, alkaloids) investigated are present in leaves and seeds of *Senna obtusifolia* except saponnins which is absent in both extracts. This is contrary to observations made by Doughari, et al, [5]. They were able to detect saponin in acetone extract of Senna obtusifolia. This could be suggestive that environment could be the determining factor of presence or absence of saponin in *Senna obtusifolia* plant.

Flavonoids are more abundant in seed extract (99%) than in leaves extract (66%). and Alkaloids absent in seeds and only 33% in leaves. The high percentage of these phytochemicals in both plant leaves and seeds demands for processing before use. The leaves could be cooked and the roasting the seeds sis necessary before eating [1]. These observation calls for further research in the use of *Senna obtusifolia* as food, medicine and animal feeds.

The results of various nutrients and mineral (Table 2), shows that the nutritive value of seeds was higher compared to those of the leaves. This plant has good nutritive value, which supports their use as food, fodder and a good source of important nutrients for livestock. The crude protein, fat and fibre showed variation in their content. The leaves have comparatively low fat, protein and

carbohydrate but high content of fibre. The seeds contain low fibre with comparatively high fat, protein and carbohydrates showing high nutritive value. They are thus, good for younger people and anemic patients.

Table 2: Percentage nutrients in leaves and seeds of *Senna obtusifolia*

Nutrients	Leaf	Seed
Crude fat (%)	0.3	3
Crude fibre (%)	2.6	0.2
Moisture (%)	77	4
Ash (%)	5.11	6
Protein (%)	5.42	18.46
Carbohydrate (%)	12.17	68.54
Nitrogen (%)	0.87	2.95
Sodium (ppm)	0.42	0.25
Copper (ppm)	0.10	0.17
Manganese (ppm)	0.40	0.17
Calcium (ppm)	2.64	1.92

The concentration of Na was higher in the leaves. It contributes in ionic balance of the human body, maintains tissue excitability and carries normal muscle of gastric juice in stomach [17]. Cu was higher in seed. Cu is an important component of many enzyme systems such as cytochrome oxidase, lysyl oxidase and ceruloplasmain, an iron-oxidizing enzyme in blood [18]. Cu deficiency has been associated with cardiac abnormalities in human and animals, causing anemia and neutropenia [19]. Nitrogen was higher in seeds. It plays an important role in the digestion of food and growth [20], but in excess is harmful. Calcium was higher in leaves, though also sufficient in seeds for the building and maintaining of strong bones and teeth, it forms large part of human blood and extra cellular fluids. It is also necessary for normal functioning of cardiac muscles, blood coagulation, milk clotting and regulation of cell permeability [21]. Calcium deficiency causes rickets, back pain, osteoporosis, indigestion, irritability, premenstrual tension and cramping of the uterus [22].

Further research into the use of *Senna obtusifolia* as food, medicine and in feed formulation for livestock is proposed.

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